

ing, and is fully illustrated. Formulæ for reagents, stains, &c., then follow, after which certain types are selected and full directions given for demonstrating root, stem, floral, cell, and other structures. This section is illustrated with twenty-three coloured plates of the specimens, beautifully executed and with ample descriptions. The author is to be congratulated on the success which he has attained in the production of this work.

R. T. HEWLETT.

### LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

#### The San Francisco Earthquake of April 18.

THIS disastrous earthquake was remarkable for its long duration and the rotatory character of the movement. As observed at Mare Island the first sign was a very faint, gentle rustling, the waves being the merest tremors; but after about a minute's duration they had grown to such proportions as to be felt by everyone. The violent phase lasted about forty seconds, and then the shocks died out, the last feeble tremors vanishing about three and a half minutes from the time of the first perception. The writer was favourably situated for noting the slightest disturbance, and had been awake some time before the first tremors were felt, and he could see the clock face at the beginning and end of the disturbance, which read about 5h. 11m. and 5h. 14m. 30s. Two of the four astronomical clocks at the Mare Island Observatory were stopped by having their pendulums thrown upon the ledge which carries the scale for measuring the amplitude of the swing. The time of the violent oscillation thus automatically recorded was 5h. 12m. 37s., Pacific Standard Time, eight hours slow of Greenwich. The waves were mainly from the south and south-south-west, and they seemed to turn to the west, giving the movement an elliptical, clockwise rotation. The pendulums of the two clocks which kept moving had their points rubbed against the swing index of the ledge so violently that the metal of the index was brightened by the friction of the pendulum points, and the time thereby deranged more than twenty seconds. Except for the disturbance of objects on the ground, the earthquake seemed to be essentially noiseless. Other slight shocks have continued at irregular intervals for the past five days.

T. J. J. SEE.

U.S. Naval Observatory, Mare Island, California,  
April 23.

#### Interpretation of Meteorological Records.

I REGRET that, owing to absence from home, I have only now seen Mr. Lander's letter in NATURE of April 19; I have to apologise for my inexcusable carelessness in writing of the storm as being accompanied by rain in place of snow and hail. However, accepting Mr. Lander's correction, it does not appear that the change will produce any alteration in the interpretation of the records, as it does not matter whether the water fell in the liquid or the solid state; its presence in either form would check any rise of temperature due to compression in the downward moving air. Any difference in the effect of snow compared with rain in producing a downward movement of the air would be to make the current stronger, because the air offers greater resistance to the fall of snow than to rain.

It is very interesting to know that at the place where Mr. Lander made his observations the barometer began to rise before the first hail arrived. But if the interpretation offered of the records be correct, this would only seem to indicate that his place of observation was not directly under the area where the storm began, and that the compression produced by the falling hail and snow travelled outwards and caused a rise in his barometer before the storm cloud brought the hail to him.

Baveno, Italy, May 7.

JOHN AITKEN.

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### RECENT PUBLICATIONS OF THE BUREAU OF AMERICAN ETHNOLOGY.<sup>1</sup>

WE welcome the long-looked-for monograph on the Hako ceremony of the Pawnee by Miss Alice C. Fletcher, the Thaw Fellow of Harvard University, as upon her, so to speak, has fallen the mantle of Cushing. Not only has she a long and intimate acquaintance with certain tribes of the Plains Indians, but her affection for and sympathy with the Indians is so marked that the old and prominent natives have confided to her their sacred lore; and she was even able to induce Tahirussawichi to come to Washington, he being the keeper of the old and sacred objects, whose life has been devoted to the acquisition and maintenance of certain sacred rites. In 1898 he was taken to the Capitol and the Library of Congress. While the vastness and beauty of these structures gave him pleasure, they did not appeal to him, for such buildings, he said, were unfitted to contain sacred symbols of the religion of his ancestors, in the service of which he had spent his long life. He admired at a distance the Washington Monument, and when he visited it he measured the base by pacing, but he would not go up, saying, "I will not go up. The white man likes to pile up stones, and he may go to the top of them; I will not. I have ascended the mountains made by Tira'wa."

The purpose of the ceremony was twofold: (1) to benefit particular individuals by bringing to them the promise of children, long life, and plenty; (2) to establish a bond of friendship and peace between two distinct groups of people. It is intertribal, and not only serves as a means for the interchange of ideas through contact and through gifts, but represents one of the many powerful agencies which, by spreading tolerance and friendly feeling, tend to weld scattered warlike bands of men into great, peaceful nations. A desire for offspring was probably the original idea. The ceremony is very old, and has been modified in the process of time to adapt it to changed conditions of environment. For example, the substitution of the buffalo for the deer, and the transference of songs; thus one formerly sung while on a journey to the mesa is now sung within the lodge.

"Each ritual contains one general thought, which is elaborated by songs and attendant acts. These songs and acts are so closely related to the central thought that one helps to keep the other in mind, and they all form a sequence that, in the mind of the Pawnee, can not logically be broken. The compact structure of the Hako ceremony bears testimony to the mental grasp of the people who formulated it. As we note the balancing of the various parts, and the steady progression from the opening song of the first ritual to the closing prayer in the twentieth, and recall the fact that the ceremony was constructed without the steadying force of the written record, we

<sup>1</sup> "Hopi Katchinas." Drawn by Native Artists. By Jesse Walter Fewkes.

"Iroquoian Cosmology." First Part. By J. N. B. Hewitt. Twenty-first Annual Report of the Bureau of American Ethnology. 1899-1900. (Washington, 1902.)

"Two Summers' Work in Pueblo Ruins." By Jesse Walter Fewkes.

"Mayan Calendar Systems, II." By Cyrus Thomas. Twenty-second Annual Report. Part i., 1900-1901 (1904).

"The Hako: a Pawnee Ceremony." By Alice C. Fletcher, assisted by James R. Murie. Music transcribed by E. S. Tracy. *Ibid.* Part ii. (1904).

"The Zuñi Indians; their Mythology, Esoteric Fraternities, and Ceremonies." By Matilda Cox Stevens. Twenty-third Annual Report, 1901-1902 (1904).

"Mexican and Central American Antiquities, Calendar Systems, and History." Twenty-four Papers. By E. Seler, E. Förstmann, P. Schellhas, C. Sapper, and E. P. Dieseldorff. Translated from the German under the supervision of C. P. Bowditch. Smithsonian Institution, Bureau of American Ethnology. Bulletin 28 (pp. 682). (Washington: Government Printing Office, 1904.)

"Haida Texts and Myths; Skidegate Dialect." Recorded by John R. Swanton. *Ibid.* Bulletin 29, 1905.

are impressed, on the one hand, by the intellectual power displayed in the construction, and, on the other, by the sharply defined belief fundamental to the ceremony."

Miss Fletcher gives the music and exact translation of the songs, with a native explanation of their meaning. The ritual objects are illustrated by several coloured plates. This sympathetic interpretation of an ancient ritual deserves the careful study of those interested in comparative religion or in the beginnings of literary expression.

Mr. J. N. B. Hewitt gives the first part of a careful study of Iroquoian cosmology; three texts, with literal and free translations, are given of Onondaga, Mohawk, and Seneca variants. A fact of great importance in these texts is that man-beings were in Iroquoian thought the primal beings; they belonged to a rather vague class of which man was the characteristic type. Beast gods appear later. In the development of

obvious that it would be very difficult to give anything like an adequate account of this storehouse of data. The ceremonies are described with that commendable wealth of detail which characterises the work done by the best American students, and the book is a worthy extension of earlier studies of the Zuñi by the lamented Cushing and by Dr. J. W. Fewkes. The Pueblo Indians are the most interesting of North American aborigines, owing to the effects the wonderful desert-land has upon the social condition of the people, and to the intricate and symbolic ritual they have evolved, which also may in a real sense be said to be a direct result of their environment. It is therefore with great satisfaction that we welcome additions to the already voluminous literature concerning these charming people. Mrs. Stevenson says:—

"The philosophy of the Indian, as of man wher-



FIG. 1.—The Kurahus in ceremonial dress. A Kurahus is the director of the Hako Ceremony; the name means an old man who is venerated for his knowledge and experience.

Iroquoian thought animals, plants, rocks, and streams, having human or other effective attributes or properties in a paramount measure, were regarded as the controllers of those attributes or properties, which could be made available by *orenda* or magic power. Thus began the reign of beast gods, tree gods, and their kind, but the native term usually translated into English as "god" really signifies "disposer" or "controller," and each received worship and prayers.

In a profusely and beautifully illustrated memoir of over six hundred pages Mrs. Matilda Cox Stevenson has given us an elaborate account of the mythology, esoteric fraternities, and the ceremonies of the Zuñis, as well as brief sketches describing the everyday life, arts, and customs of the people. It is

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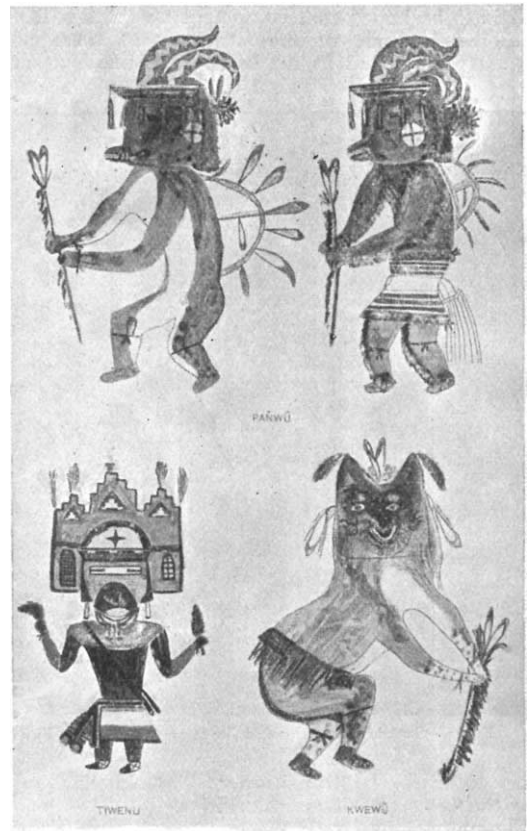


FIG. 2.—Hopi Kachinas drawn by native artists. Pañwû is represented by the two top figures. The figure Tiwenu carries a tablet on the head and a pine branch in each hand. The Kweñu picture has a well-drawn wolf's head with projecting mouth. The kilt is made of horse-hair stained red.

ever found, is the result of his desire and his efforts to understand the mysteries of nature. These children of the human family are highly imaginative. The soul of the Zuñi expands with adoration toward the supreme mysterious power that controls all things, and toward the gods, whose forms are visible in the heavens above, in the earth beneath, and in the waters under the earth, who are only less mighty than the supreme power, and who bless the good and punish the wicked."

She admits it is yet to be determined what part clanship played in the dawn of the ritualistic life of the Zuñi.



"It is certain that for a long time past membership at large in the fundamental religious bodies of the Zuñi has not been dependent on the ties of clan-ship, though in certain cases succession to office in fraternities does depend on clan-ship. Before any exposition of the origin of the fundamental religious organisations and of the ritual can be offered, a comparative study of the Pueblos must be made. In this work the passing hours are golden, for not only are the villages losing their old-time landmarks, but the people themselves are changing, are adapting themselves to a suddenly and profoundly altered environment, and the Zuñi at least, whose religion teaches them to speak with one tongue, to be gentle to all, and to subdue the passions, thereby winning the favour of their gods, are, under the influence of modern conditions, losing the restraining power of this religion, and, as a result, are changing for the worse."

It is to be hoped that competent students will make a thorough study of the sociology of these people without delay, and at the same time make a serious

ritual there are dramatic celebrations of the arrival and departure of the katchinas, and during the whole year there are ceremonies in which katchinas take part. The annual ceremonies vary considerably each year, so the katchinas are correspondingly numerous, and not only have clans introduced new katchinas from time to time, but individuals have done the same even by men still alive. Some of these ceremonies have developed into a regular dramatic performance; the motive of one of these dramas is the growth of corn, with representations of the maleficent and beneficent agencies that affect the crop. The performance is designed primarily to invoke the favour of the mysteries by appropriate symbols combined with the edification of the community at large. Thus a portion of the chamber is set apart as a stage, while the greater portion is reserved as an auditorium. A screen on the stage is painted with appropriate symbols, and is perforated to permit the passage of the masked effigies representing the mystical potencies, which are operated by shamans hidden behind the screen, something after the fashion of marionettes. The front of the stage is occupied by a symbolic field of corn, and the figures which represent the storm and drought emerge from their respective apertures in the screen and destroy the cornfield; but they are opposed partly by musical and other incantations of a group of shamans occupying one side of the stage, and partly by human actors who wrestle with and finally overcome the evil marionettes. The entire dramatisation stands on a higher plane than any prevalent among other tribes of the territory of the United States, though lower than that reached among the Nahuatlans and Mayan peoples of Mexico.

Under the title of "Two Summers' Work in Pueblo Ruins," Dr. Fewkes describes his survey of certain ruins mainly in the Province of Tusayan. Dr. Fewkes's excavations confirmed some statements made by the Hopis concerning their former history, and his intimate knowledge of the ritual and cere-

monies of the existing Pueblo Indians has enabled him to explain the use or significance of objects dug up by him. The report is illustrated by photographs of ruins, plans of buildings, and a large number of beautifully executed coloured plates of decorated pottery, besides numerous figures in the text. The author inclines to the belief that the Zuñis never advanced to the same perfection in the ceramic art as did the Hopis. The author says, "In the evolution of Pueblo decoration the development of ornamentation advances from geometrical patterns to rude picture writing, and, as a rule, the pottery on which the former predominate is inferior to that on which the latter is most prominent"; but this hardly seems consistent with the subsequent remark that "the more ancient the ruin is, the better is the pottery."

Dr. Cyrus Thomas gives the second portion of his study of Mayan calendar systems, in which he deals with Maudslay's investigation of the ruins at Quirigua and discusses Goodman's results. The paper includes an account of the Maya method of calculation.

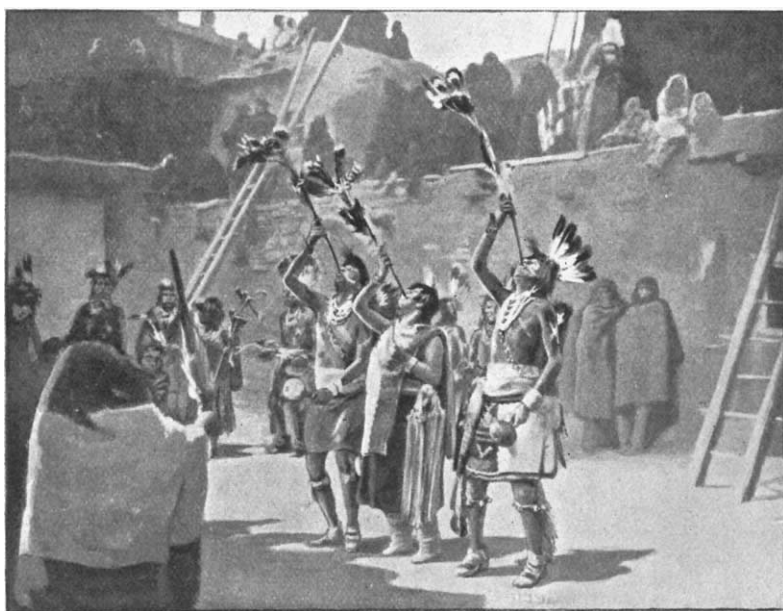


FIG. 3.—Sword Swallowers of Ma'ke Hlan nakwe (Great Fire Fraternity of the Zuñis).

effort to trace the transition of the old clan system into the later religious fraternities.

The memoir by Dr. J. W. Fewkes on Hopi Katchinas drawn by native artists cannot fail to be of considerable interest to students of various departments of ethnology. The practice of illustrating ethnological researches by native drawings is much to be recommended, as the drawings throw considerable sidelight upon the ideas and skill of the artists, and help us in the study of their psychology; in the present instance they have additional value in the suggestive similarities they present to pictographs in the codices of more southerly regions. The term katchina was originally limited to the spirits of the ancients of the Hopi or personified medicine power, and personifications of a similar power in other objects have likewise come to be called katchinas. Thus the magic power or medicine of the sun or earth may be called katchina. The term is also applied to personations of these spirits or medicine potencies by men, or their representation by pictures or images. In the Hopi

Serious English-speaking students of Central American archaeology must know the writings of the distinguished German scholars whose names appear in Bulletin 28 under review; but even they will be glad to have these scattered papers translated for more convenient reference and collected in one volume. Other students who like to know what is being discovered in this region will be very thankful to Mr. Bowditch for his enterprise and labour in translating these papers, and to the Smithsonian Institution for placing all this material at their disposal in so convenient a form. On the whole, these papers will be of most value to those who concern themselves with the chronology and history of the Central American peoples; but there is a great deal to interest the general ethnologist, though he will have to search for his material, as most of it is scattered all over the volume in diverse papers. Particularly interesting in this respect are the papers on "Zapotec Priesthood and Ceremonials," "Deities and Religious Conceptions of the Zapotecs," and "Comparative Studies in the Field of Maya Antiquities"; the last paper deals with the clothing, personal decoration, and utensils of the Mayas as illustrated in the manuscripts, or on the monuments or other remains. According to a widespread tradition, the Toltecs were the originators of all arts and sciences; and the invention of the calendar is ascribed to them, and we are informed they carried their book with them on their migrations. The calendar is the fount of the Central American sacerdotal wisdom, and the great mass of Mexican and Maya manuscripts is nothing more than an elaboration of this calendric system in respect to its numerical theory, its chronology, and its system of divination. The book is copiously illustrated, and altogether it will form a most welcome addition to the working library of various kinds of students of archaeology and ethnology.

Mr. Swanton gives literal translations of a number of Haida folk-tales obtained on the Queen Charlotte Islands, British Columbia; this careful piece of work will be much appreciated by folklorists.

When one looks at the bulk of ethnological matter published by the United States Government, and realises the enormous value to students of these full, accurate, and well-illustrated memoirs, one cannot but feel ashamed of our Government, which, possessing every opportunity and inducement to study and report upon our own native races, does absolutely nothing.

A. C. HADDON.

#### THE EDUCATION AND TRAINING OF THE ENGINEER.

ENGINEERING in its various branches takes so large and important a part in the industrial activities of modern nations that no pains are too great which will secure for our engineers a suitable and adequate school and college training, supplemented by a judiciously organised scheme of practical work in the shops and drawing office. More especially is this the case in this country, where, owing to the satisfaction which has followed previous success, manufacturers have been insufficiently alive to the fact that for many years other nations have been steadily building up efficient schemes of technical and professional education at the cost of much enterprise and greater self-sacrifice, with the natural result that our supremacy, long undisputed in these spheres of industry, has been undermined, and in some degree wrested from us.

It is for reasons such as these that the investigations inaugurated and carried out under the auspices of the Institution of Civil Engineers, the results of which are

embodied in a recent report on the education and training of engineers, are to be welcomed. In November, 1903, the council of the Institution appointed a committee to consider and report as to the best methods of training for all classes of engineers, including both scholastic and subsequent technical education, it being an instruction of the council that the principle was to be maintained that the education of an engineer must include both practical experience and scientific training. The constitution of the committee was completed in February, 1904, and owing to the wisdom and breadth of outlook of the council of the Institution of Civil Engineers, accredited representatives of the various institutions of mechanical, electrical, gas, and mining engineers, naval architects, shipbuilders, and others were added to the committee, which under the able chairmanship of Sir William White, K.C.B., F.R.S., was soon actively at work.

The inquiry, which has extended over more than two years, proceeded under the following sections: (1) Preparatory education in secondary schools; (2) training in offices, workshops, factories, or on works; (3) training in universities and higher technical institutions; (4) post-graduate work. The investigations under the first heading were entrusted to a subcommittee, while the committee as a whole undertook the consideration of the questions arising under the remaining three sections. The inquiries of the committee have been prosecuted by obtaining, sometimes orally though generally by correspondence, the opinions of teachers and professors with experience in engineering education, and of eminent engineers practising in various branches of the profession. The ultimate result is that, though diversities of opinion have been disclosed in regard to some details, yet, in all the main features of its recommendations, the committee has support from the great majority of professional engineers as well as of the professors of engineering subjects in our universities and higher technical institutions.

#### PREPARATORY EDUCATION.

The subcommittee, entrusted with the work of ascertaining the views of authorities competent to speak concerning the most suitable form of secondary education for boys destined to become engineers, issued a schedule of questions to 120 representative teachers in engineering colleges, headmasters of secondary schools devoting special attention to scientific training, and engineers not engaged in teaching. The queries raised in the schedule dealt with such points as the proper age for leaving school, the desirability of a leaving examination for secondary schools, the extent and methods of the teaching—suitable for future engineers—in English subjects, languages, mathematics, science, drawing, and surveying. The schedule of questions raised, in addition, the important subject as to how far schoolboys should have, as a school exercise, practice in ordinary handicraft work, such as carpentry or turning; and to what extent it has been found better to make all "practical" work into laboratory exercises in science. Replies were received from 80 per cent. of the gentlemen whose opinions were invited, and from these definite conclusions were deduced as to the prevailing opinion on the points raised in the schedule of questions. These conclusions were embodied in a report of the subcommittee, which was eventually approved and adopted by the main committee. The following recommendations are the outcome of the exhaustive inquiry.

A boy intended for the engineering profession should, before leaving school and commencing to specialise, have attained a standard of education equivalent to that recognised by universities for matriculation